Section Life Cycle Management

Working Groups

International Expert Group on Life Cycle Assessment for Integrated Waste Management

Review of the 10th Meeting, Heidelberg 15th – 16th May 2003

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1 Roundtable Updates – Developments, Studies and Tools

1.1 Update from IFEU Institute, Heidelberg

JÜRGEN GIEGRICH introduced a number of IFEU activities including:

- A finalised study on landspreading options for sewage sludge versus incineration. Landspreading will be banned in Germany in favour of incineration.
- A study on anaerobic co-digestion of Municipal Solid Waste (MSW) and sewage sludge. Workshop proceedings are available (German language).
- An LCA on four hazardous wastes and treatment options, including electroplating sludges, oil separation sludge and foundry sands.
- A study on cement kiln incineration of 20 organic waste streams and 16 MSW Incinerators.
- A number of German Packaging Ordinance studies with beverage manufacturers for refillable systems to prove or disprove eligibility for scheme.

Jürgen also explained a new German policy shift away from source separation for MSW to mass treatment and separation methods, provided these methods accord with strict regulatory emission limits.

1.2 Update from ENEA (Energy Department, Sustainable Energy Systems Division), Italy

PAOLO MASONI outlined a new Italian initiative for waste management. Product-service declarations are planned for landfill, incineration and composting. The purpose is to benchmark within a service activity not to compare activities against each other (ie between waste management options). A draft for landfill is available at http://www.environdec.com/psr/datasheet.asp?id=86

1.3 Update from Ecoemballages, France

BREFFNI BOLZE has produced a waste systems financial costs model. The tool (which is free) focuses on operational costs and does not include revenue, subsidy or CAPEX costs. A new version of WISARD was released in France in January. Details are available at http://www.ecobilan.com/index_fr.html

The French work will now focus on promotion of the tool and developing guidance on use and interpretation of results. A statistics report of normative data (in French) has been produced.

1.4 Update from UK Environment Agency

BERNIE THOMAS presented an update on WISARD, and explained that a data collection contract for replacement software for WISARD has been let. The contract focuses on updating existing data and new and emerging technologies data. The software development contract is pending. Part of the work will be to develop best practice guidance for use, simplified standard results and normalised data for interpretation, similar to the French methodology. Terry Coleman presented an update on the UK waste strategy position. The Environment Agency will monitor biodegradable targets diversion for the Landfill Directive. An emissions permit trading scheme for municipal waste to landfill will be legislated for, planned to begin mid 2004. Landfill directive bans for hazardous waste are a concern. The UK government will use landfill tax monies to form a new waste strategy unit. Terry also presented information on the development of a new Decision tool. A Best Practicable Environmental Option toolbox is planned in the UK to help municipalities choose integrated options for MSW strategies. This will comprise a) forecasting tool b) multi-criteria assessment tool c) LCA tool, d) Detailed costs model e) Contract tender and monitoring tools. With respect to current LCA work, studies on Tyres and Nappies are ongoing and are planned to deliver later in 2003.

1.5 Update from Sweden

ANNA BJÖRKLAND described the recent controversy in Sweden following high profile assertions from the former head of the Swedish EPA that it was more environmentally friendly to burn everything except newspapers and cardboard. Swedish incineration capacity will double over the next 5 years but a draft 'ecocycle' biowaste law has been tabled to restrict the growth of incineration. A counter argument for sorting specific materials from a Nordic LCA network for waste management could not respond in time or gain sufficient media interest to publicise nationally. Orware (a LCA model developed at the Royal Institute of Technology (KTH), Stockholm) has been used for two dissertations. Anna has written papers on sensitive parameters and consensus on LCA materials recycling studies. She has also been asked to write a chapter on LCA for waste management in new LCA text aimed at being a definitive text for LCA practitioners. The Nordic LCA network is planning a series of workshops

for Spring 2004, one of which may be on LCA for waste management case studies and technical issues.

1.6   Update from US EPA

SUSAN THORNELOE explained that some cities such as New York City have cut back on recycling programs. Assistance has been provided using EPA's Municipal Solid Waste Decision Support Tool (MSW-DST) to help identify options for reducing costs while considering life-cycle environmental tradeoffs. There is also increased interest in operating landfills as a 'bioreactor' where leachate and other liquids are used to encourage degradation of the waste and increase available air space. EPA's Office of Research and Development has a Cooperative Research and Development Agreement (CRADA) with Waste Management, Inc. to evaluate the performance of as-built and retro-fit bioreactors using a full-scale facility in Kentucky. This evaluation also includes measurement of fugitive gas emissions using optical remote sensing. The EPA's Office of Research and Development also has a CRADA with the Environmental Research and Education Foundation to conduct measurements of raw landfill gas and combustion by-products from boilers, engines, flares, and turbines. Data on persistent bioaccumulative toxics (PBTs) will also be collected for pollutants such as mercury including any emissions of methyl- and dimethyl- mercury. The data from both CRADAs will be used to help update EPA's emission factors for landfill gas emissions. They will also be used in evaluation of residual risk which is part of the Urban Air Toxics program.

1.7   LCA in developing countries – update from Boku University, Austria

STEFAN SALHOFER explained that one of his researchers based in Lima is about to begin 3 years research on the use of LCA in waste management policy in developing countries. Conditions are evidently very different – waste generation is 200 kg per annum, back street materials separation, 80% uncontrolled landfill. The group discussed some known studies e.g. Mexico, Nairobi, Chile. LCA models have been adapted to model no leachate and gas capture. The group discussed that social and economic aspects take precedent and that life cycle thinking might be preferential for developing countries as complex LCA can be counter productive. Waste oil cited as major developing world problem worthy of LCA study.

2   Results Communication and Interpretation in Decision-making

SIMON AUMÔNIER (ERM, UK) provided a presentation on communication and interpretation issues based on experience gained using WISARD in UK waste planning and strategy development. Key issues were defined as:

- Clarity. What has been assessed? What do the results mean? Why LCA for waste? Why are environmental benefits expressed as negative numbers? What is scientific notation?
- Credibility. How robust are the tools? What is best practice?
- Application. How to use and interpret? Choice of indicators, Use of valuation and weighting.

The key points of the presentation were:

- For waste management, communication difficulties are compounded by the fact that decision-making for MSW is normally an openly democratic multi-stakeholder process, involving the opinions of elected officials, public, pressure groups, planners and waste managers and planning inspectors each with varying entry level technical knowledge and technical capability.
- Need to start at the basic level and explain a) what waste management systems are and their differences b) why LCA is useful in assessing waste management systems (avoids burden shifting in systems, objectivity, resource view).
- A number of techniques are available to practitioners to help communicate to a general audience e.g. summary flow diagrams, context and normalised data, multi-criteria analysis and indices and qualitative indicators.
- Peer review can help to alleviate some scrutiny concerns of planning inspectors and best practice determination can help alleviate concerns of study bias raised by stakeholders.

3   Research Activities

3.1   LCA initiative of the European Commission's DG – JRC

DAVID PENNINGTON explained that the role of the JRC IES Soil and Waste Unit is to conduct research, to inform and support DG Environment and DG Enterprise. Specifically an LCA initiative has been started to increase the availability and accuracy of LCA data (both LCI and LCIA) in support of European policy. The short-term objective of the initiative was to survey and define a strategy for coordinating the development of LCI databases. The JRC is now seeking input from existing sector stakeholder networks (such as waste management, energy, specific materials) comprising industry, public authority and academic groups to facilitate the development and capture of this data. The long-term objective is to provide a European LCA reference database that provides quality assured data that can be used in tools in support of European policy. Research training activities especially for accession countries are also part of the initiative.

3.2   LCA activities at Engineering Faculty of Porto University and Portuguese Catholic University Portugal

SUSANA XARA presented an overview of her work. LCA for waste management is beginning to be more widely accepted in Portugal by industry, some municipalities and the Environment Ministry. Susana's work includes: the application of LCA using IWM-2, WISARD for Portuguese waste management systems; EIA of Incineration and Landfilling of Alkaline Batteries; LCA of Alkaline battery treatment; Packaging case studies a) PET versus Glass b) PET versus Tetrapak; and MSW and greenhouse gases case study for the County of Oporto

3.3   Persistent and bioaccumulative organics and inorganic substances (POPS)

JÜRGEN GIEGRICH presented a history of the various international chemical protocols over the past 20 years for emissions registers concerning elimination, restricted use and reduction of substances. The purpose was to begin to define

minimum requirements for LCI for waste management. Discussion then centred on the fact that these lists were long and exhaustive and whether LCA cut-off rules should and could be applied, or whether prioritisation was necessary for waste management. Discussion also focused on measurement and whether Dioxins should be speciated. A new EU Chemicals list with 93 banned substances is expected.

4 Results from LCA Study Programmes

4.1 Comparison of waste treatment technologies for Switzerland

STEFANIE HELLWEG (ETH, Zurich) presented a study comparing conventional end of pipe systems with maximum recycling scenarios and a technical innovation scenario involving a future pyrolysis/gasification/incineration scenario. The technical innovation scenario was found to have lowest overall environmental impact using Ecoindicator 99 methods. The application of temporal cut-offs was shown to be important for comparative assertions over which scenario was best. For instance, over 100 years, heavy metals were shown to be unimportant, but for an infinite timeframe were shown to be significant to the outcome. Materials recycling generally scored better than end of pipe treatment. However, composting may be worse than incineration if no fertilizer credit is given and an infinite time horizon used.

4.2 Results from the US EPA programme

SUSAN THORNELOE presented an update on EPA's research to develop tools towards more holistic decision making. Two tools are being developed. The first is a database that contains life-cycle inventory data for all of the waste management processes including collection, transportation, transfer stations, transportation, recycling, composting, combustion and landfilling. It also contains life-cycle inventory data for both the national and regional electrical grids in the U.S. These data are presented in the SPOLD format. The second tool is the MSW-DST which was developed with an extensive list of stakeholders representing state and local government, solid waste management industry, trade associations, environmental interest groups, academia, and the aluminium, glass, paper, plastics and steel industries. The tool provides analysis of the life-cycle inventory tradeoffs and full costs for managing 26 different MSW components. The MSW-DST has been applied in over 30 different regional and municipal studies including Atlanta, Minneapolis, Seattle,

and Vancouver. The tool has also been used to help on a site-specific basis to help identify potential options for further GHG reductions. Currently underway at EPA's Office of Research and Development is the development of a web-accessible version of the MSW-DST which will provide a simpler user interface and a streamlined version of the tool.

5 Technical Issues

5.1 Landfill time dependency discounting issues

ANNA BJÖRKLAND presented a paper outlining the key questions and approaches on how landfill emissions are modelled in LCA. It was argued that an indefinite timeframe, or very long term modelling is necessary because: 1) this is most compatible with LCA, which claims to be holistic and models all emissions and 2) there is a moral, ethical argument that LCA modelling should consider all the possible emissions that future generations might face. Stephanie Hellweg presented research on discounting and the environment. This approach considered ethical societal beliefs and net present value economic principles to understand discounting. It was argued that the four principles of economic discounting could be applied to LCA for waste management for a discount near or low to zero. Counter arguments were provided that the research was dependent on the assumption that society had a common ethical code and that this code remained constant over time. It was also emphasised that LCA provides potential impacts only, but rate of release were key i.e. understanding impacts (complex dose, source and pathway relations and risks), the assimilative capacity of the environment (threshold limit values) and knowledge of how long toxins etc were retained in biogeochemical systems. Simon Aumônier described outlined an approach where LCA modelling could consider defining a break point where discounting would influence a comparative assertion.

5.2 Treatment of carbon in LCA for waste management

GUDRUN WASSERMAN (Boku University, Austria) provided an overview of the approaches concerning carbon sequestration and modelling for LCA for waste management. Approaches differ due to complexity over counting the permanence of carbon sequestration in Landfills, paper recycling, offsetting and the sustainability of forestry, and temporal storage of carbon in waste management systems versus fossil fuel and carbon. As general guidance it is thought necessary to differentiate between biogenic and fossil fuel carbon in the carbon cycle.